Hydrogen Planning in Poland and Germany

Subjects: Management

Contributor: Tomasz Jałowiec, Dariusz Grala, Piotr Maśloch, Henryk Wojtaszek, Grzegorz Maśloch, Agnieszka Wójcik-Czerniawska

The use of hydrogen exists in various sectors in Poland and Germany. Hydrogen can be used in industry, transport, decarbonisation of the Polish steel industry and as one of the low-emission alternatives to the existing coal applications in this sector.

Keywords: hydrogen ; green energy ; renewable energy

1. Introduction

In Poland, possibilities for using hydrogen exist in all sectors, particularly in industry and the transport sector. In industry, the use of renewable or low-carbon hydrogen in ammonia production and refineries can help reduce greenhouse gas emissions associated with existing hydrogen use [1][2][3].

The deployment of hydrogen can contribute to the decarbonisation of gas supplies in industry and, in the long term, can be used as a low-carbon solution for supplying high-temperature process heat [4][5][6][7][8].

Hydrogen may be a solution for the decarbonisation of the Polish steel industry, which is currently still dependent on the carbon-based steel production process. In the transport sector, the greatest chances for the implementation of hydrogen lie in the Polish road and rail sector. In the built environment, hydrogen can decarbonise the existing use of natural gas, but it can also be used as a low-carbon alternative to existing coal uses in this sector [9][10][11].

In Poland, the possibilities for using hydrogen in industry are significant. First of all, the Polish industry has a significant market share in the production of ammonia and refining capacity in Europe. These industries already consume hydrogen from fossil fuels, which can be replaced with renewable or low-carbon hydrogen. In addition, natural gas accounts for almost a quarter of the industry’s energy mix, and the use of renewable or low-carbon hydrogen is one way to decarbonise gas supplies [12].

Hydrogen is a low-carbon energy carrier that is well suited to decarbonising this part of the energy demand. Finally, the Polish steel sector accounts for 6% of the EU’s primary steel production and can be decarbonised by switching from conventional fossil fuel-based steel production processes to a process where iron in direct reduction is produced using hydrogen [13][14][15].

The assessment shows that although Poland has included hydrogen as a key transport decarbonisation solution in its National Action Plan to reduce carbon dioxide emissions with several supportive measures, there is still scope to develop a comprehensive framework for the deployment and use of hydrogen in other sectors (construction and industry) [16][17].

Poland considers hydrogen a key area to be explored as part of its R&D activities to support investments in hydrogen-related production assets, storage and distribution infrastructure, final application, and in the development of materials for energy storage [18][19].

Poland is the main beneficiary of the Modernization Fund and believes that this funding should be allocated to investments in line with climate policy, to support the implementation of the NECP (National Contact Point—European partnership for clean hydrogen) measures for investments related to hydrogen and fuel cells [20].

Under its NECP, Poland will support national research on clean coal technology (CCT), including the production of hydrogen from coal gasification, to generate electricity using the IGCC (gas combination cycle), or for use in fuel cells [21][22].

Poland acknowledged that additional measures may be needed to deploy hydrogen refueling stations and encourage the use of hydrogen cars. The NECP also pointed out that the power system faces increasing risks due to the increasing

generation of variable power generation, and that there is a need to pay more attention to technologies, such as the use of hydrogen, that allow the integration of these transform sources [23][24].

2. Hydrogen Planning in Poland

Poland is preparing a hydrogen technology development program aimed at introducing hydrogen applications in the electricity, transport and gas industries, while reducing the consumption of traditional fossil fuels [25].

The program covers hydrogen production, transport, storage, distribution and final use, taking into account the EU and Polish legal framework. Hydrogen can become an important area of economic development in Poland [26].

The program covers all possible uses of hydrogen, from large factories to homes, and the introduction of hydrogen would fulfill three main objectives: to increase the competitiveness of energy companies; increase the security of the energy supply and benefit the Polish economy as part of the energy transition [27][28][29].

Hydrogen produced from electricity can be sent to the natural gas network and combined with carbon dioxide to produce synthetic methane, thereby improving the quality of biogas.

The share of renewable electricity in total electricity consumption will increase from the current 1% to 32% by 2030 [30].

Gas-based generation capacity is being developed to support variable generation. Backup power plants are powered by imported gas and domestic resources, including hydrogen.

Energy conservation options are also being developed, especially in the field of renewable energy conservation (**Figure 1**) [31].

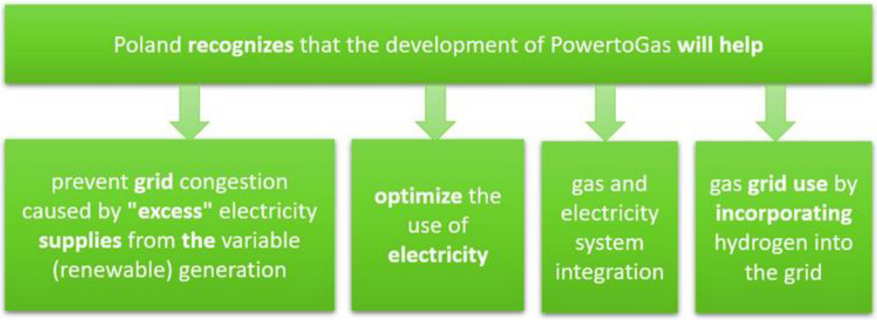

Figure 1. Poland recognizes that the development of PowertoGas will help [32].

According to the NECP, Poland will encourage the use of alternative fuels in transport, including hydrogen, in accordance with the law on “alternative fuel and electric capabilities”. Poland plans to reduce its dependence on oil imports through the increased use of cars powered by alternative fuels and the implementation of the necessary infrastructure [33].

Electricity significantly reduces carbon dioxide emissions. Efforts to fully decarbonise the transport sector are key: promoting other zero-emission vehicles, including hydrogen-powered vehicles.

Hydrogen will also be considered for decarbonisation in the rail, aviation and maritime sectors. Among the policies and measures to achieve low-emission mobility, Poland plans to promote environmentally friendly modes of transport, such as the use of fuel cell vehicles by cities to refuel and deploy hydrogen refueling stations in densely populated areas [34].

The Low Emissions Transportation Fund aims to support the rollout of alternative fuel infrastructures and begin rolling them out in the marketplace [35].

Poland has established a fund for the period 2018–2027, which supports investments for: renewable fuel production; the deployment of hydrogen delivery and delivery infrastructure; manufacturing transport equipment related to the hydrogen value chain; and purchasing hydrogen-powered vehicles and boats [36].

Poland plans to use its salt cave geological formations as underground gas storage facilities for hydrogen storage [37].

Poland plans to increase the GDP energy and climate budget to 2.5% in 2030. Poland also plans to cooperate more closely with organizations of the European Organization and other EU Member States in the field of the Strategic Energy

Technology Plan.

Poland considers hydrogen a key area to be explored as part of its R&D activities to support investments in hydrogen-related production assets, storage and distribution infrastructure, final application and in the development of materials for energy storage (e.g., carbon cells and nanostructures) [38].

Poland has significant potential for the use of hydrogen in road transport. A total of 43% of the energy used in the sector is consumed by trucks, buses and light trucks [39].

Electrification of this segment of the trucking sector remains challenging. There is a significant opportunity for the deployment of hydrogen to decarbonize this part of the trucking industry. The Polish railway industry is still dependent on fossil fuels for a quarter of total energy consumption [40].

Combined with electrification, the deployment of low-carbon or renewable hydrogen could replace the use of diesel trains. In the medium and long term, hydrogen and derived fuels can also play a role in the decarbonization of the Polish aviation industry, which still accounts for a relatively small share of the world's energy needs. Similarly, hydrogen and hydrogen-derived fuels could be deployed to decarbonize the energy used to power international ships. Although international transport and aeronautics are not currently regulated by the EU or international climate law, EU countries will need a collective effort to support decarbonisation in these areas [41].

3. Hydrogen Planning in Germany

Potential applications for hydrogen include rail, road, aviation, shipping and other industries, and many projects have already begun or are being seriously considered [42].

In rail traffic, hydrogen is particularly attractive for rails that do not have a catenary. In general road and freight transport, hydrogen would also be cheaper compared to electric vehicles, as the charging times and weight of batteries required in electric vehicles are not always economically viable [43].

Road transport currently has only 87 hydrogen fueling stations across the country. The German automobile club ADAC estimates that approximately 1000 stations are needed to ensure nationwide delivery [44].

Hydrogen can be transported in a number of ways, including pipelines, tankers and trucks. NRW has a hydrogen pipeline of 240 km, which is already suitable for transporting longer distances. Several industrial partners plan to build a 130 km long hydrogen pipeline from Lingen to Gelsenkirchen NRW (Get H2 Nucleus). Germany's transmission system operators also recently announced plans to introduce a hydrogen start network (H2-Startnetz) by 2030 to link the demand priorities of NRW and Lower Saxony with hydrogen-related green gas projects in northern Germany. By the end of 2030, the introduction of the network will require investments of approximately 660 million euros. Of the planned 1200 km, about 1100 km should be used for hydrogen transport by changing the existing natural gas pipelines, so only about 100 km remain unbuilt [45][46][47].

Salt caverns allow for the storage of more hydrogen, and Germany has cavern storage facilities with a base gas volume of approximately 11 billion cubic meters of hydrogen, where approximately 4 billion standard cubic meters are contained in NRW (**Figure 2**).

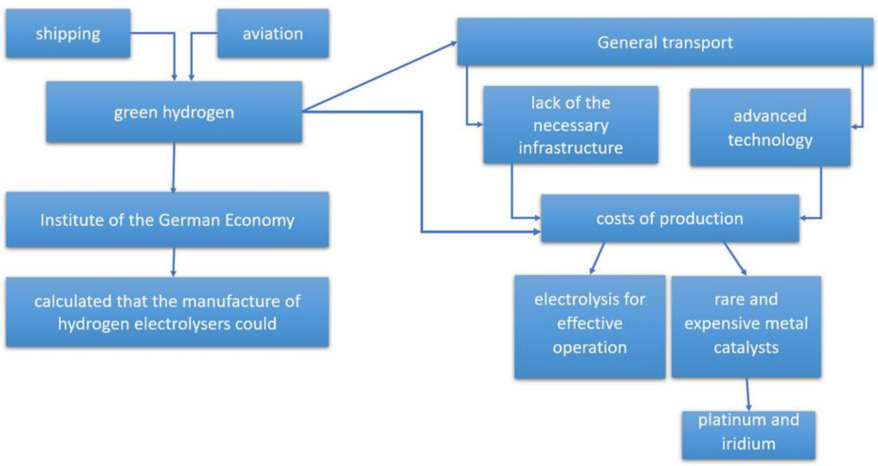

Figure 2. Green hydrogen in Germany [48].

At €10 per kg, hydrogen is still too expensive to use in general transport, especially due to the lack of necessary infrastructure (i.e., network of filling stations) and the very technology used. Production costs appear to be around €6 per kg. The electrolysis of also requires rare and expensive metal catalysts such as platinum and iridium to work effectively [49].

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